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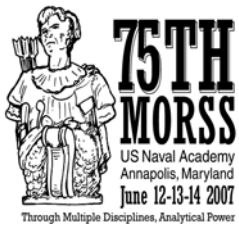

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Name of Principal Author and all other author(s):

Dwayne T Hill
Erika Chan
Mitchell Woods

Principal Author's Organization and address:	Phone: (703) 681-2749
US Army Test and Evaluation Command (ATEC)	Fax: (703) 681-6914
4501 Ford Avenue, suite 790	Email: Dwayne.thomas.hill@atec.army.mil
Alexandria, VA 22302-1458	

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NET-ENABLED BATTLE COMMAND

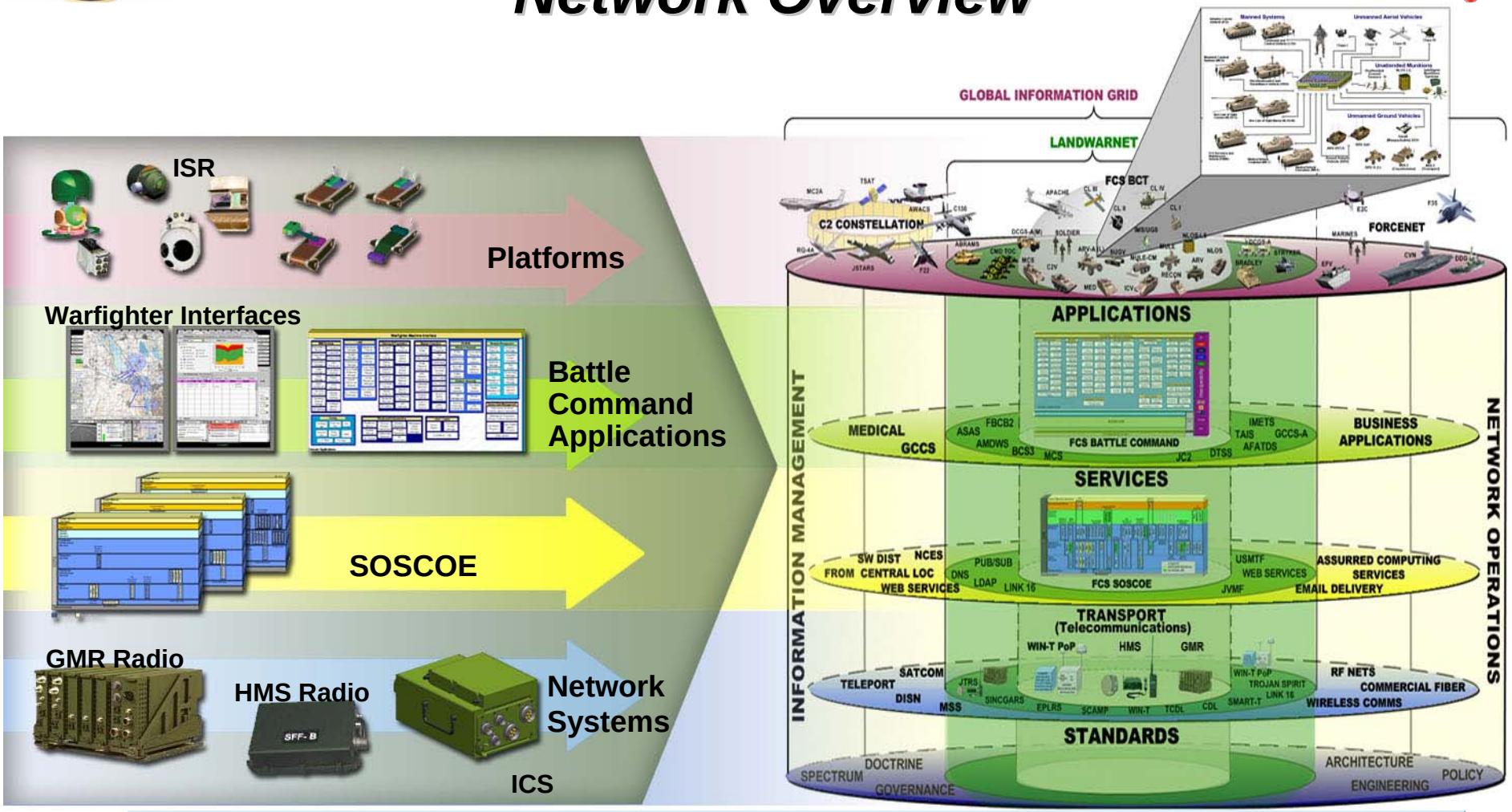
13 June 2007

Net-Enabled Battle Command
Agenda

- Net-Enabled Battle Command Test and Evaluation Concept
- Mission Domain Metric Development Methodology
- Mission Metrics
  - Speed-of-Command
  - Self-Synchronization
  - Information Superiority
  - Force Agility
- Cognitive Domain Mapping

Net-Enabled Battle Command Test and Evaluation Concept

Net-Enabled Battle Command
Network Overview



Networked systems provide data/information from and to sensors, software, computers, telecommunications, and decision-makers

Net-Enabled Battle Command

Some Definitions

- Command Net: A communications network which connects an echelon of command with some or all it's subordinate echelons for the purpose of command and control. (*Ref: FM 1.02*)

- For the Net-Enabled Battle Command concept, we assume that all of the various systems/components of the network already meet the NR-KPP requirements, as called for by the Chairman Joint Chiefs of Staff Instruction (CJCSI) *6212.01D*.

Net-Enabled Battle Command
Net-Centric Assumptions

- The Joint-described tenets of Network-Centric Warfare is that networked forces will demonstrate:
  - Improved speed of command;
  - An improved ability to rapidly synchronize among themselves;
  - An improved ability to collect, process, and disseminate an uninterrupted flow of information; and
  - An improved ability to change over time.
- Systems are Net-Ready compliant

Net-Enabled Battle Command
Capabilities-based Test and Evaluation

Varying Conditions

Inputs

Live
Virtual
Constructive

Network Environment

Network Performance

Network's ability to provide relevant information

Commander & Staff

Network's ability to enable decisions/ actions

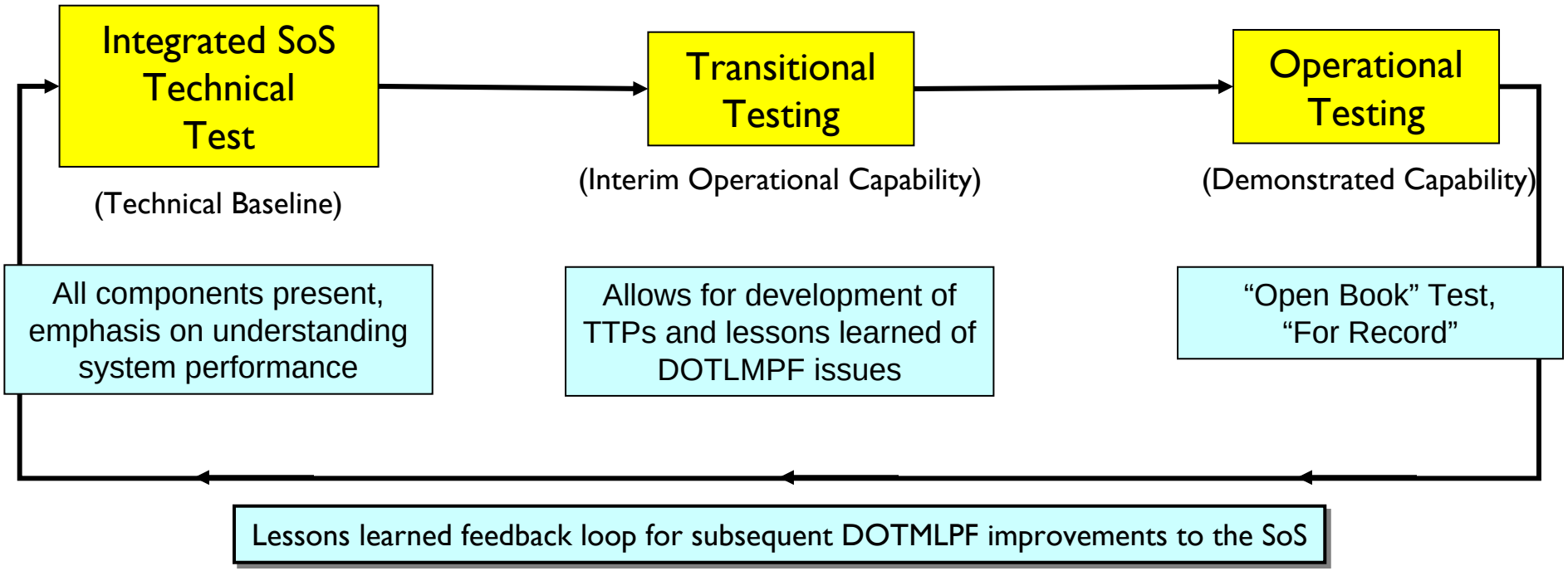
Mission Effectiveness

T&E plans must delineate this type of T&E strategy

Concurrence/non-concurrence with system documentation based on documents ability to describe the operational capabilities desired and the architecture/infrastructure of the Network Environment to support the desired operational capabilities

<u>Ability to improve</u>:
- Speed-of-Command
- Self-Synchronization
- Force Agility
- Information Superiority
- Other

Net-Enabled Battle Command
System-of-Systems T&E Events Concept



DT plan(s) focused on technical requirements, SoS Network performance, helping predict operational implications, and technical causality

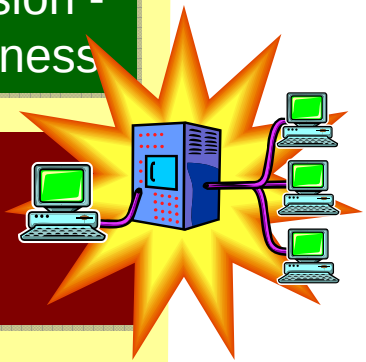
OT plan(s) focused on operational performance, capabilities and limitations in accomplishing mission(s), force effectiveness, and DOTLPF

Net-Enabled Battle Command Domains

Mission – Domain where the net-enabled force/unit demonstrates the degree to which it is able to achieve the defined future force concepts/capabilities

Cognitive – Domain where decisions are made by the decision-maker; the place where perceptions, beliefs, values, understanding, and assessments takes place

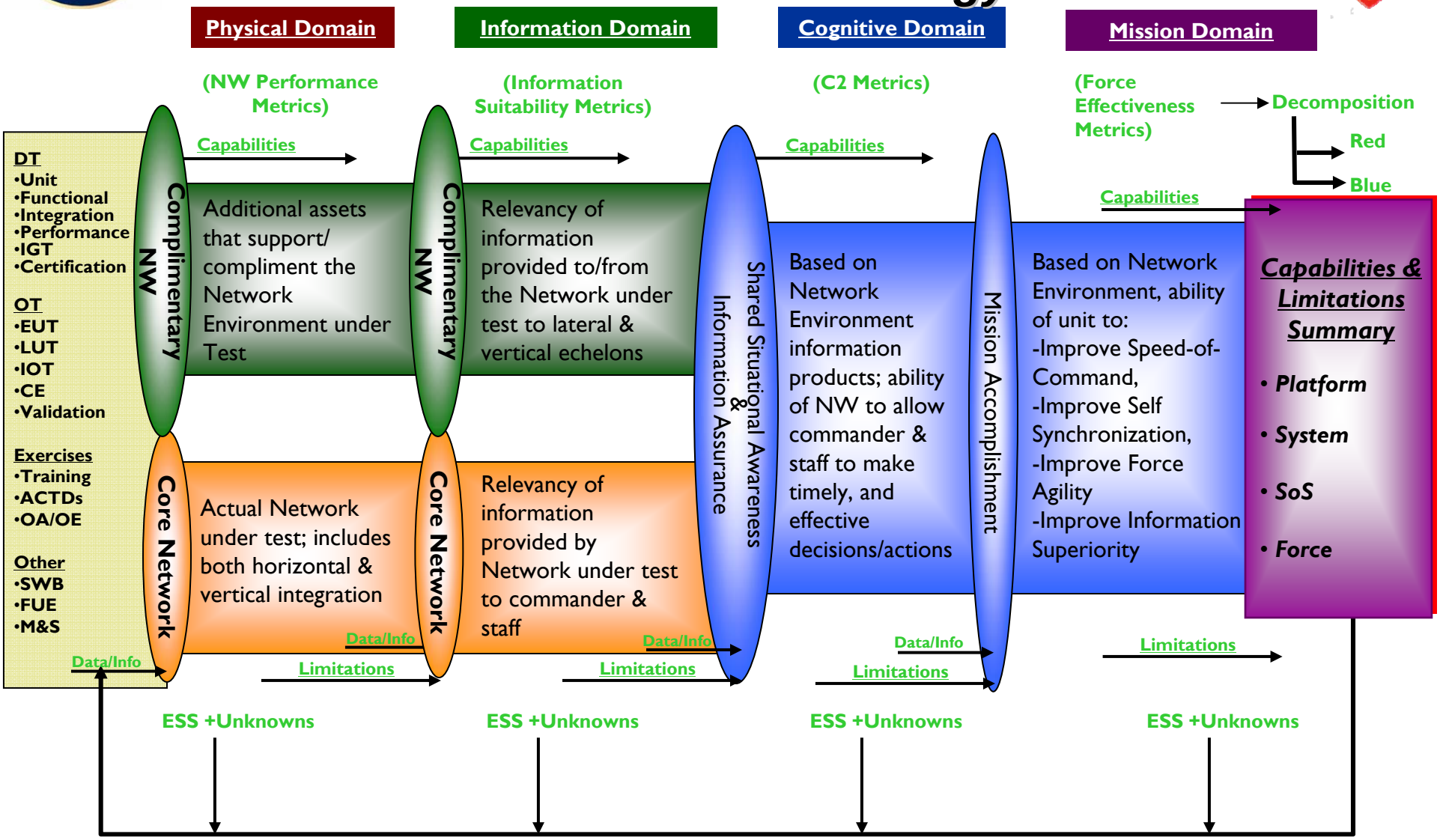
Information – Domain where relevant information is created, manipulated, processed, stored, shared and presented to the decision - maker to convey commander's intent and enable situational awareness



Physical – Domain where the components of the network reside; sensor, platform, applications, operating systems, standards and transport infrastructure

Net –Enabled Battle Command

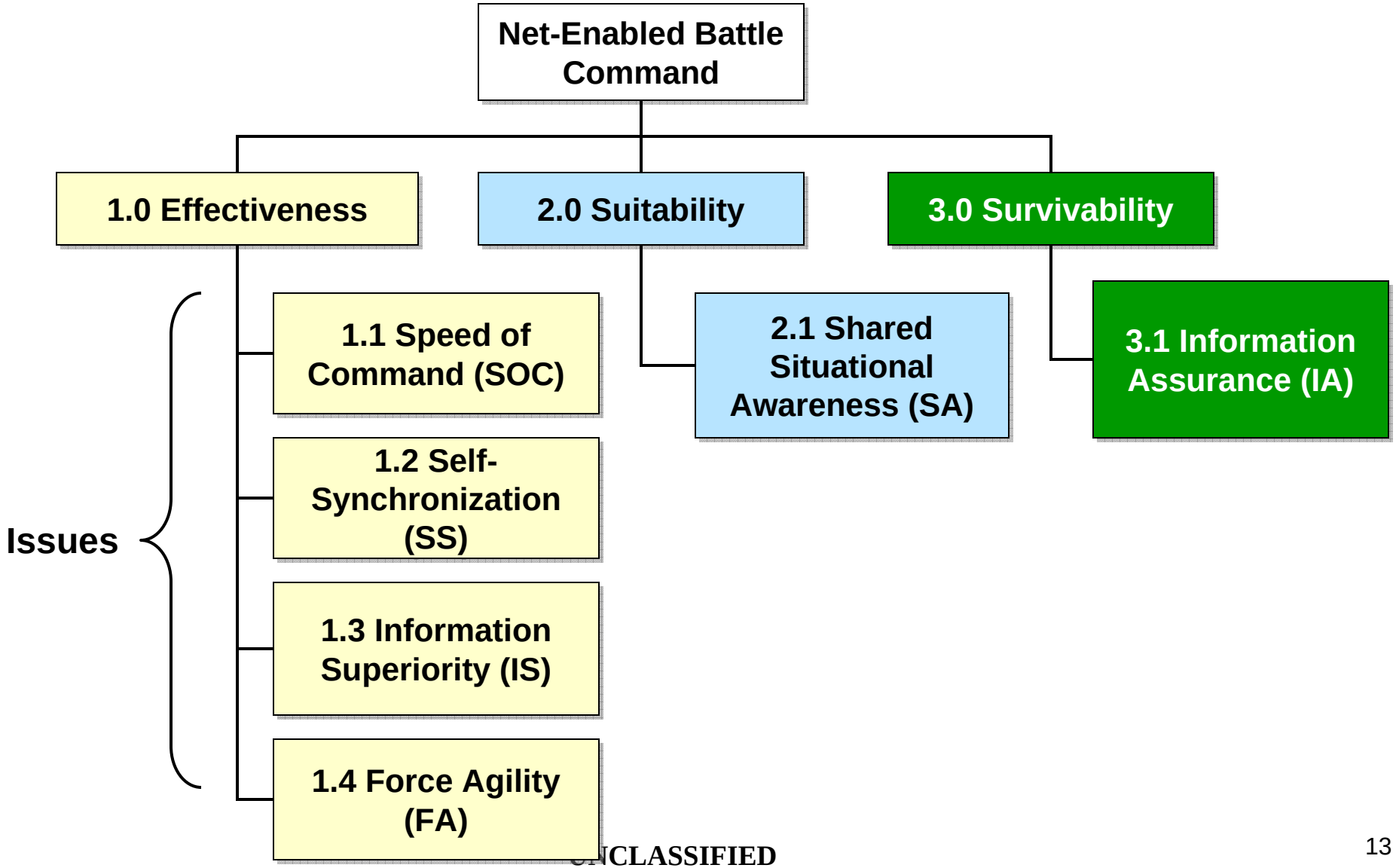
Overall T&E Methodology



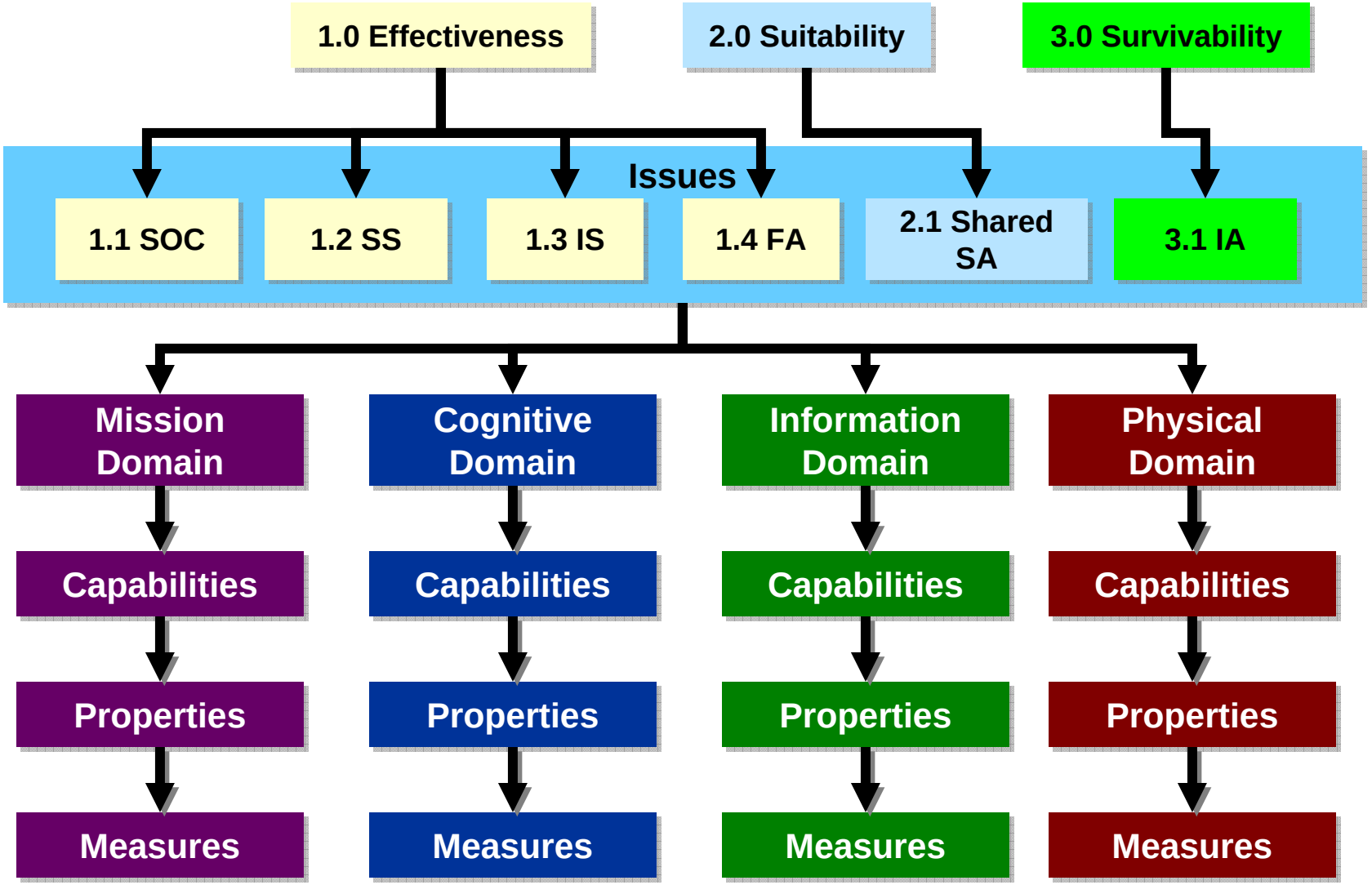
IGT - Independent Government Test; EUT – Early User Test; LUT – Limited User Test; IOT – Initial Operational Test; CE – Continuous Evaluation; ACTD – Advanced Concept Technology Demonstration; OA/OE – Operational Assessment/Operational Evaluation; SWB – Software Blocking; FUE – First Unit Equipped; M&S – Modeling and Simulation; ESS – Effectiveness, Suitability, Survivability; NW – Network; C2 – Command and Control; FoS – Family of Systems; SoS – System of Systems

Mission Domain Metric Development Methodology

Net-Enabled Battle Command
Evaluation Focus Areas



Net-Enabled Battle Command
Methodology for Defining Measures



Mission Domain Metrics

Speed-of-Command

Net-Enabled Battle Command
Mission Methodology

Speed of "Firsts"

Speed of Command, described by the OODA Loop, assesses the rapidity which you go from 1 – 4

In addition, each component of the OODA loop, O-O-D-A, assesses the time to complete each individual "first"

Assessments based on:
- JIM forces vs. Threat
- System maturity comparison (roi)

1. See First → Information Superiority
2. Understand First → Self-Synchronization
3. Decide First → Self-Synchronization
4. Act First → Force Agility
5. Finish Decisively

Assessments based on:
- Mission success
- Commander's intent
- Task/mission requirements

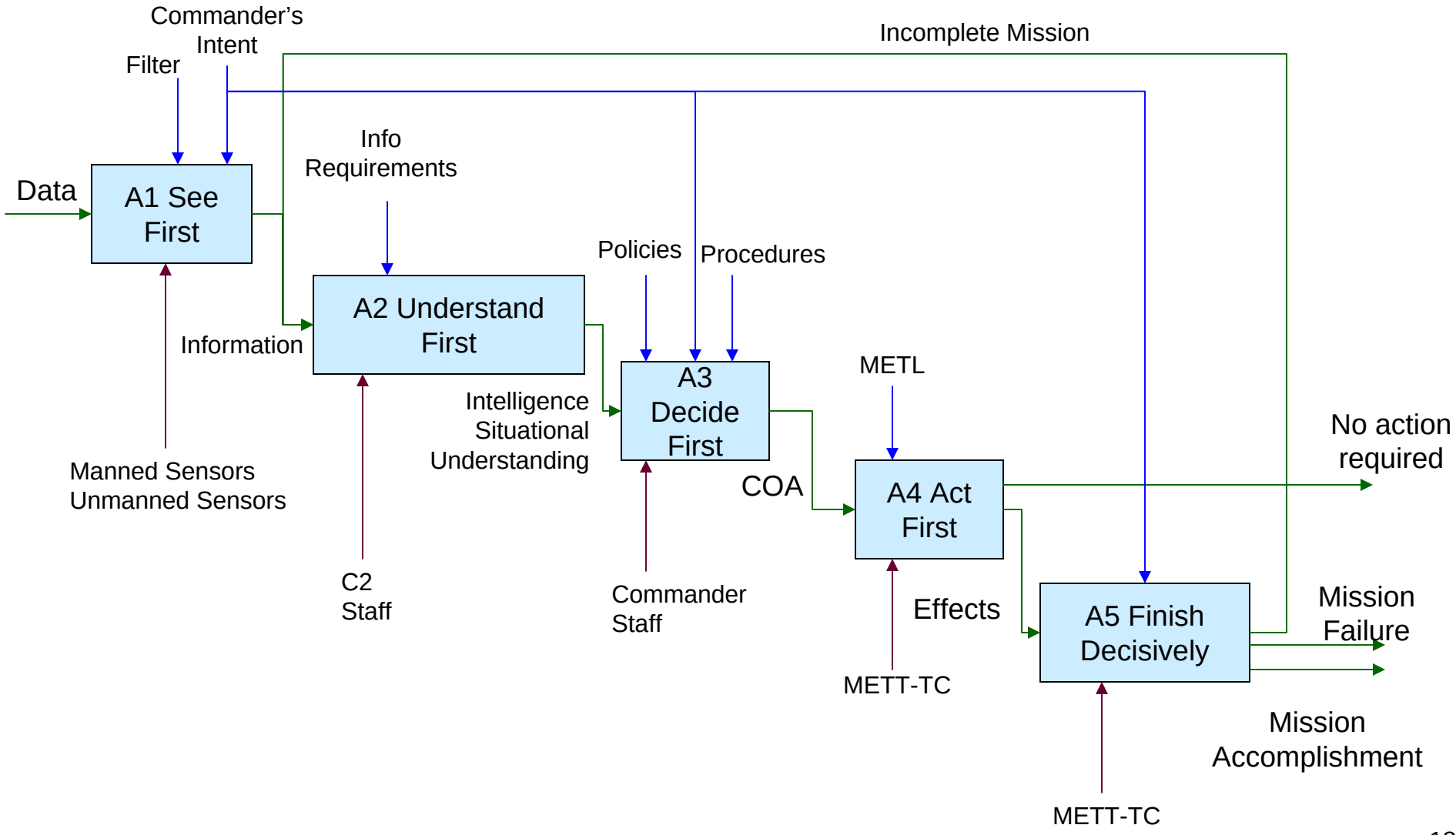
"Did I impose my will on the enemy"

Quality of "Firsts"

Assessments based on:
- JIM forces vs. Threat
- System maturity comparison (roi)

Battle Command Information Need Categories:
JIM forces status, Threat status, Terrain information, Weather information

NEBC Activity Model (OV-5)



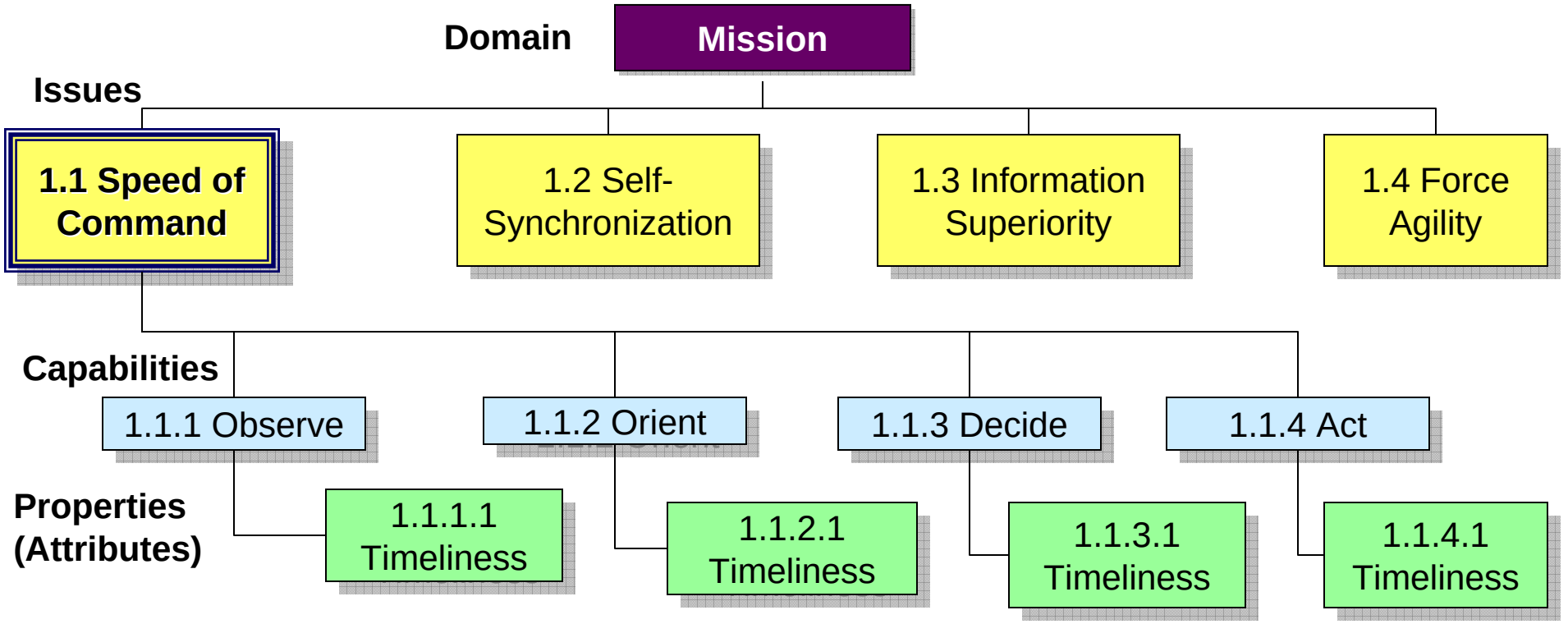
Objective of Mission Domain:

Demonstrated ability of net-enabled forces to achieve some degree of future force capability

Definition of Speed of Command:

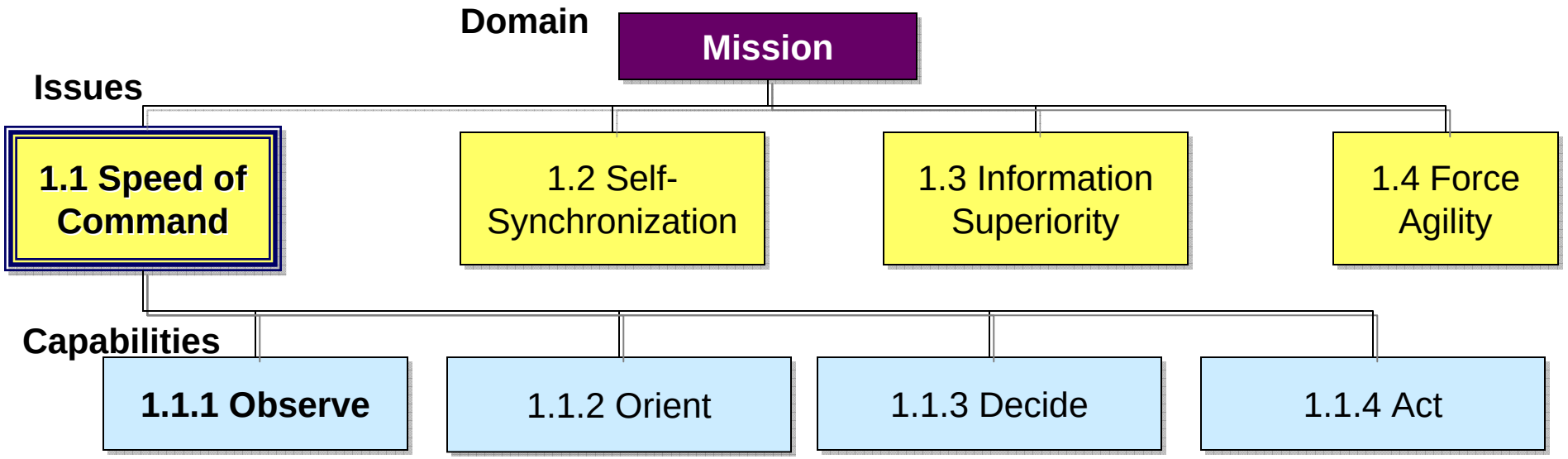
- Time required to complete one full cycle of Boyd's observe-orient-decide-act (OODA) loop

  (Ref: Network-Centric Warfare – Its Nature and Modeling, Fewell, M.P and Hazen, Mark G.)



Objective of Mission Domain:

Demonstrated ability of net-enabled forces to achieve some degree of future force capability

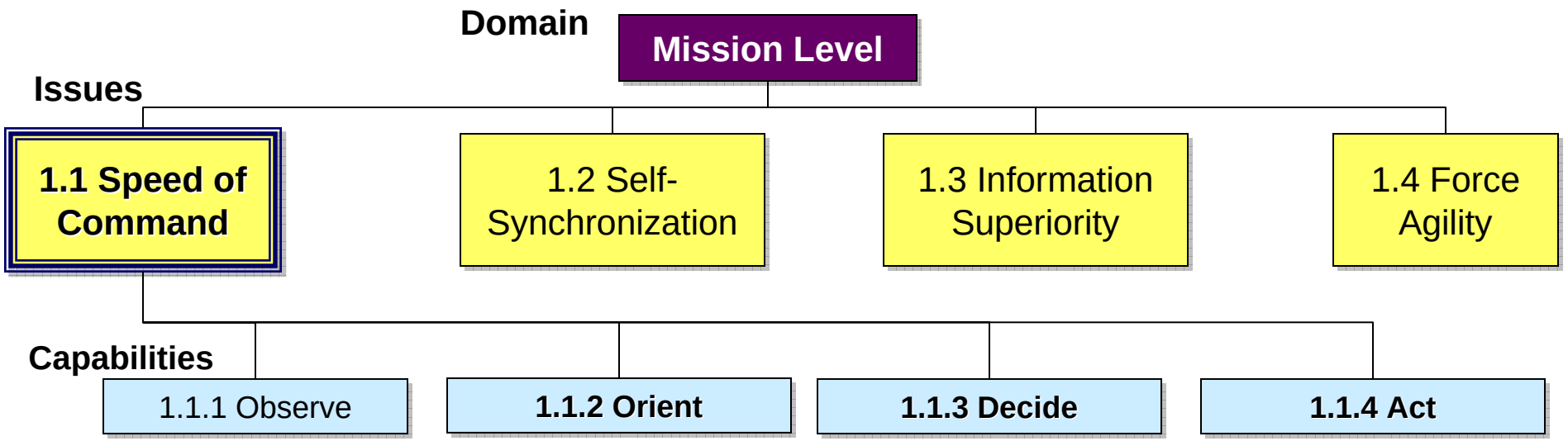


Definition of Observe:

- The act of *(time to)* collecting information. Sometimes the commander actively seeks information; sometimes the command and control (C2) system disseminates it to them. *(Ref: FM 6-0)*
- *(Time)* To learn about the status of their forces, the environment and the enemy through intelligence, surveillance, reconnaissance, information systems and reports from other headquarters *(Ref: FM 6-0)*
- An act *(Time)* to discern a target visible to a sensor (human or machine) that may be within range of available weapons. *(Ref: FM1-02, see definition for Target of Opportunity)*

Objective of Mission Domain:

Demonstrated ability of net-enabled forces to achieve some degree of future force capability



Definition of Orient:

How *(long to become)* familiar with or adjusted to facts, principles, or a situation *is the force* (*Ref: Freedictionary. com*)

Definition of Decide:

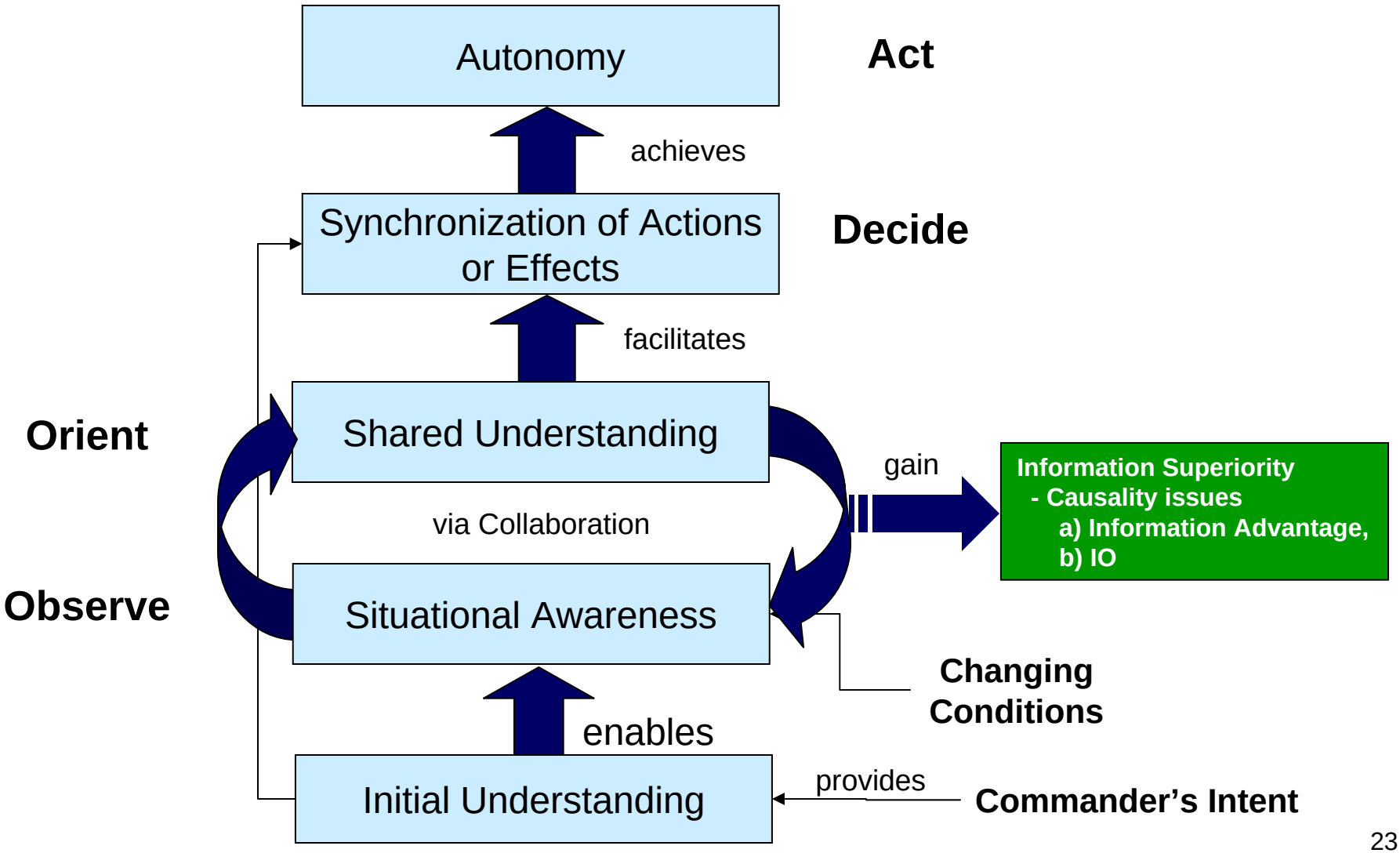
Timeliness of selecting a coarse of action as the most favorable to accomplish the mission (Ref: *FM 6-0, FM 1-02*)

Definition of Act:

Time to put decisions into action by disseminating it through execution information – orders or plans; supervising to ensure proper execution and assessing results through feedback from COP and staff running estimates; synchronize and integrate BOS as well as directing execution within the higher commander's intent. (*Ref: FM 6-0*)

Self-Synchronization

Self Synchronization

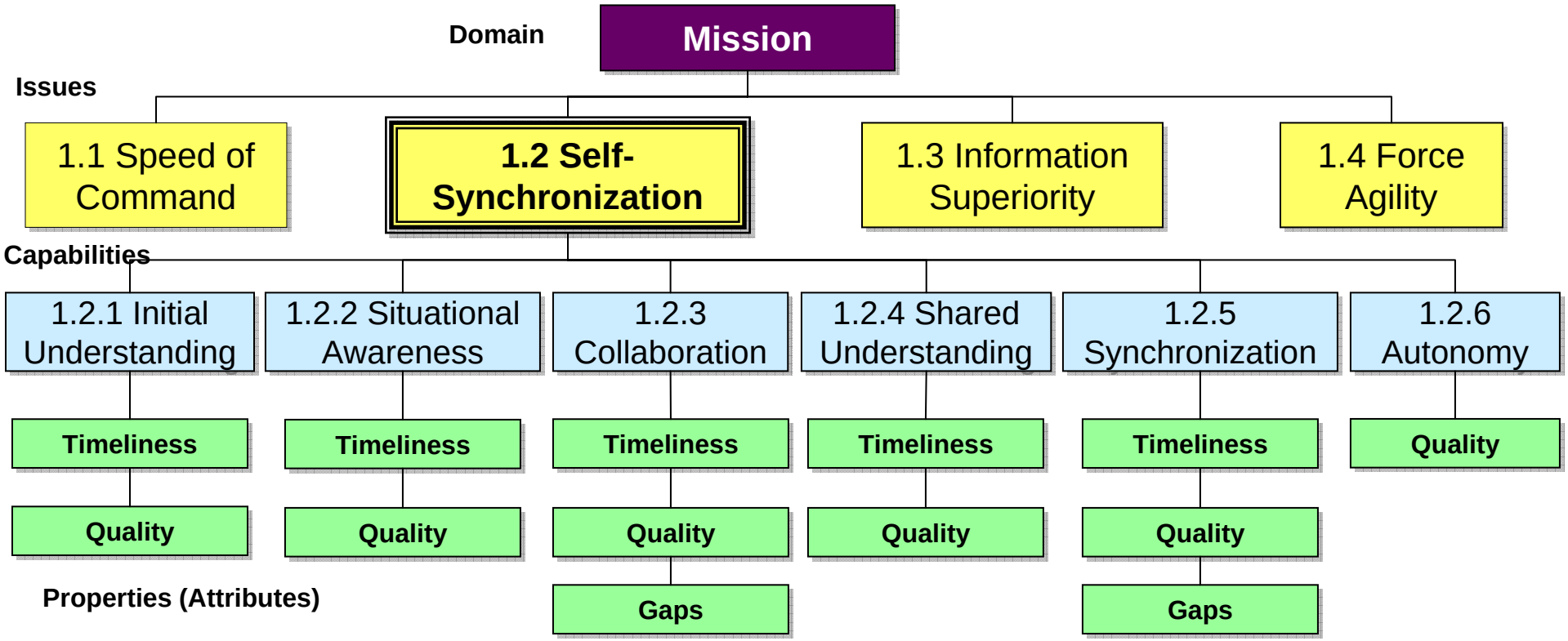


Objective of Mission Domain:

Demonstrated ability of net-enabled forces to achieve some degree of future force capability

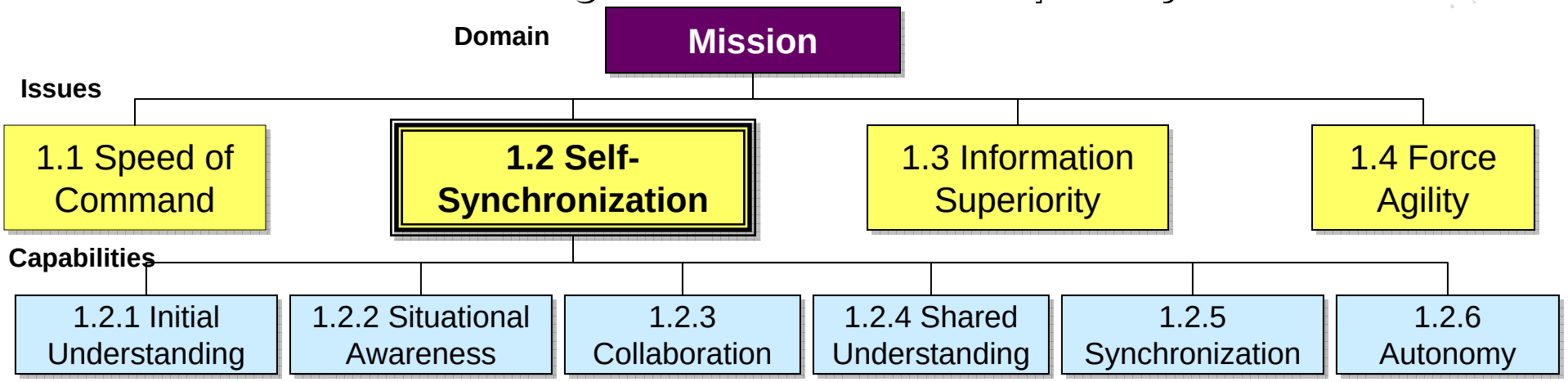
Definition of Self-Synchronization:

❖ Ability of entities to rapidly synchronize among themselves, independent of direction from superiors *(Ref: Network-Centric Warfare – Its Nature and Modeling, Fewell, M.P and Hazen, Mark G.)*



Objective of Mission Domain:

Demonstrated ability of net-enabled forces to achieve some degree of future force capability



Definition of Initial Understanding:

- *Time for and degree that* all subordinate commands have higher commander's plan(s) and intent?

Definition of Situational Awareness:

- *Time for* knowing who's where and what are they doing? (*Ref: JFC*)
- The *quality of* perception of relevant elements in the environment, the comprehension of their meaning and the projection of their status in the near future. (*Ref: Endsley*)

Definition of Collaborate:

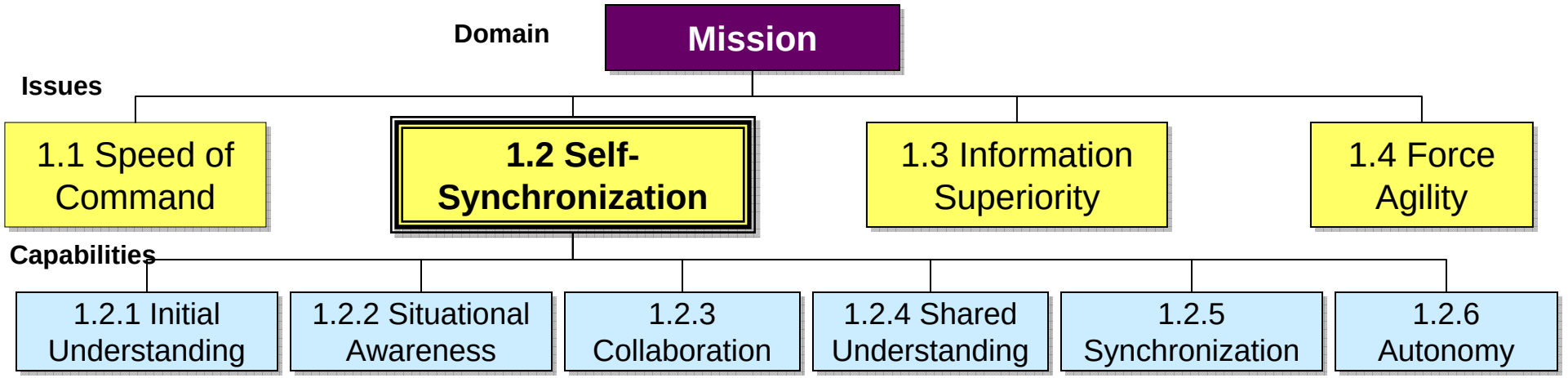
- Given the network, how well can subordinate entities work together to plan and execute missions and tasks?

Definition of Shared Understanding:

- *Time for subordinate commands to gain and the quality of* common understanding of a situation

Objective of Mission Domain:

Demonstrated ability of net-enabled forces to achieve some degree of future force capability



Definition of Synchronization:

- The *time required to* arrange military actions in time, space and purpose to produce *maximum (precise)* relative combat power at a decisive place and time. (*Ref: FM 3-0*)
- *Time to* arrange military actions by forces and BOS in time, space and purpose to produce maximum *(precise)* relative military power at a decisive place and time. (*Ref: FM 6-0*)

Definition of Autonomy:

- Successfully conducting military operations through decentralized execution based on mission orders for effective mission accomplishment (Quality)
  - Degree of independency in making decisions
  - *Success of* conduct*(ing)* military operations through decentralized execution based on mission orders for effective mission accomplishment.

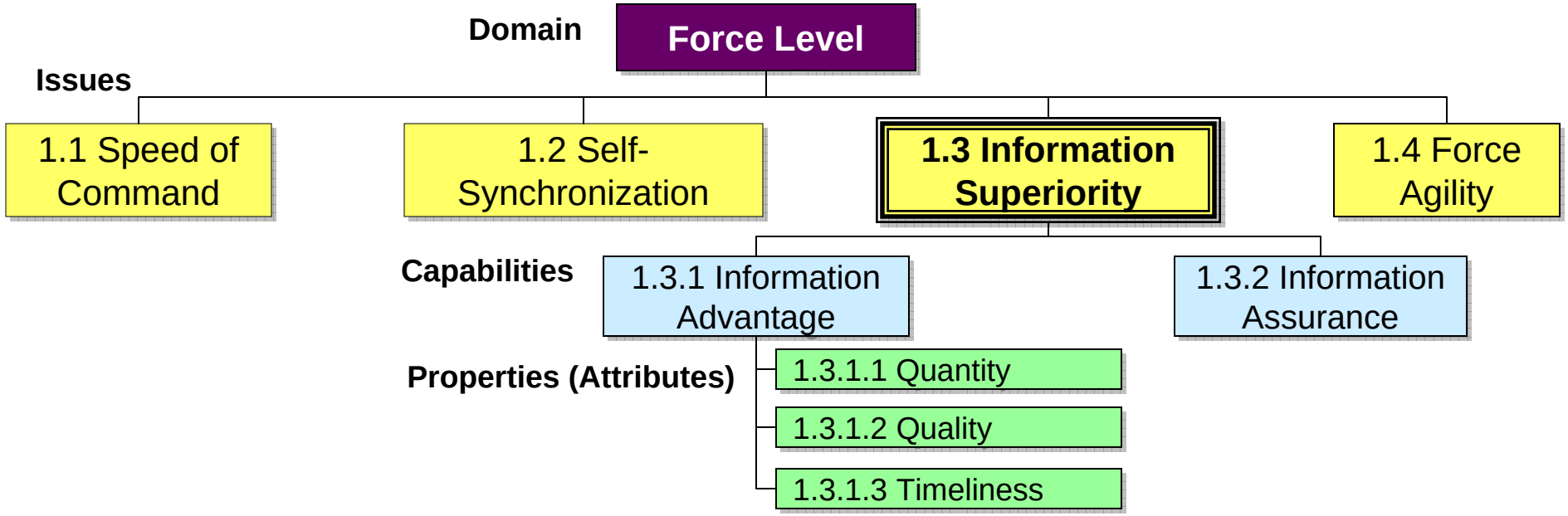
Information Superiority

Definition of Force Level:

Demonstrated ability of net-enabled forces to achieve some degree of future force capability

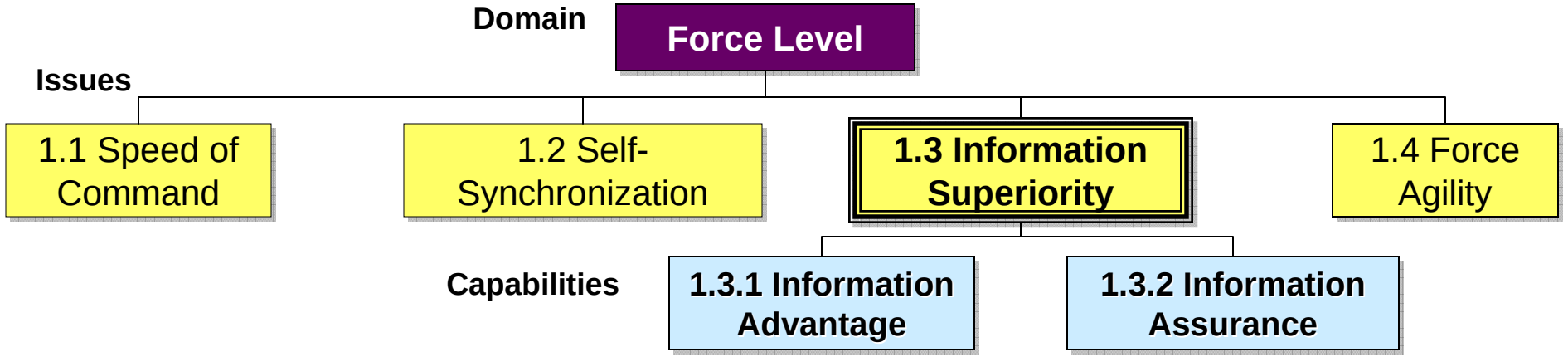
Definition of Information Superiority:

- The operational advantage derived from the ability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same. (FM 3-0)



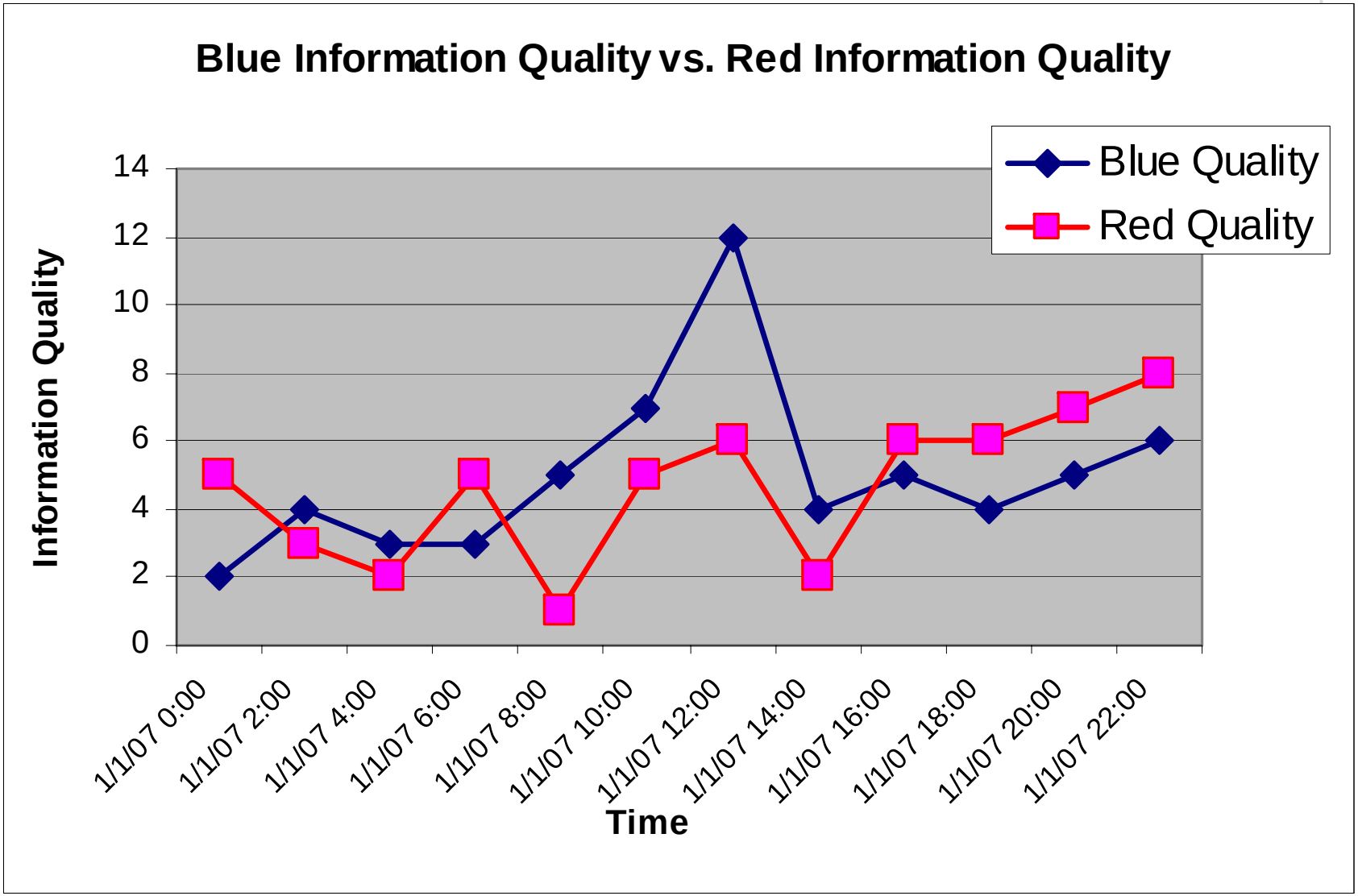
Definition of Force Level:

Demonstrated ability of net-enabled forces to achieve some degree of future force capability



- **Information Advantage:** The ability of one opponent to answer his information needs at a rate greater than his adversary can answer his information needs.
- **Information Assurance:** Measures that protect and defend information and information systems by ensuring their availability, integrity, authentication, confidentiality, and non-repudiation. This includes providing for restoration of information systems by incorporating protection, detection, and reaction capabilities.

I-3 Information Superiority Measures



Force Agility

Definition of Mission:

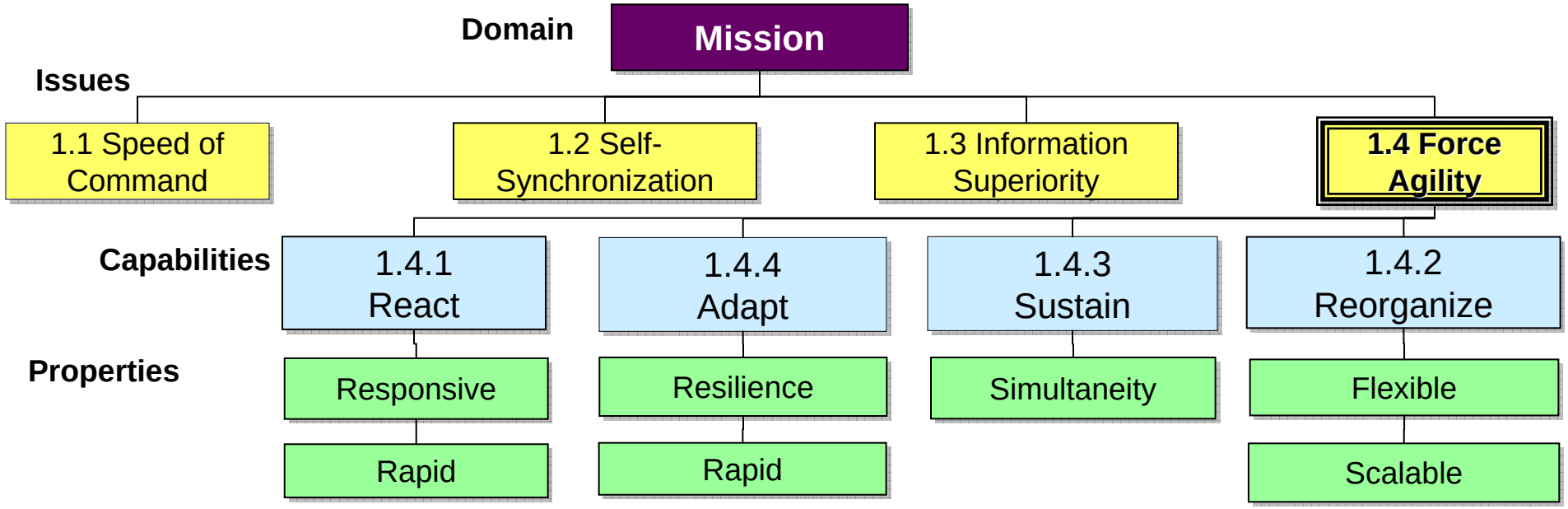
Demonstrated ability of net-enabled forces to achieve some degree of future force capability

Force Agility

❖ A responsive, agile force package is one that is sustainable and mobile enough to accomplish the mission. *(FM 3-0)*

❖ Ability of a force to rapidly react to changing conditions, especially regarding unplanned and ad-hoc circumstances, and revise its organization to handle them; Ability to alter the nature of engagement quickly (adapt) and the ability to sustain several types of engagement simultaneously, as required.

❖ Agility implies an ability to change over time. *(Ref: Network Centric Operations Conceptual Framework)*



Definition of Mission:

Demonstrated ability of net-enabled forces to achieve some degree of future force capability

Definitions of Force Agility Properties

Responsiveness

❖ The degree to which decisions and actions are timely and relevant. *(NCE JFC 1.0)* Responsiveness is a function of timeliness and relevance.

Resilient

❖ The extent to which recovery or adjustment is achieved given misfortune or change. *(NCE JFC 1.0)*

- ❖ Recovery – Reestablishment of the baseline prior to a given misfortune or change

Scalable

❖ The extent to which organizations can seamlessly adjust size and scope to meet a given mission requirement. *(NCE JFC 1.0)*

Simultaneity

❖The extent to which engagements occur at the same moment *(Modified from Houghton Mifflin Company)*

Sustainment

❖The extent to which an engagement maintains and prolongs operations or combat until successful accomplishment or revision of the mission. (Modified from CJCSI 3170.01E)

Flexible

❖The extent to which individuals and organizations dynamically meet mission requirements. *(NCE JFC 1.0) (See Cognitive measures)*

Cognitive Domain

NOTE: Measures/Sub-measures may apply to more than one Force-level Characteristic capability

Environmental factors

Predecessor

Influence

SPEED OF COMMAND

PHYSICAL NETWORK

PHYSICAL WORLD

Responsiveness

Decision Soundness

Decision Speed

Capabilities

Intuitive Decisionmaking

AoA Decisionmaking

Information Assurance

Information Quality

1

N

Situational Understanding

AoA

1+n

1 or 1+n

Problem solving and decisionmaking (Equal to 1 or N)

Feedback loop

Judgment

1 or 1+n

Friendly IO

Feedback loop

Trustworthiness

Soundness

Properties

ENEMY Information Operations

Sensor

Information Systems

Processing

Network Boundary

MANPRINT Conditions

System Safety

Health Hazards

Soldier Survivability

Command Climate

Pressures (CDR, Time, situational)

Key Communicator /Trusted Agent

Physical Conditions

Physical fatigue

Physical combat stress

Workload

Direct Sensing

COGNITIVE

Interpretation

Perception

Situational Awareness

Intelligence cycle

Int

Intelligence

information

Cognitive Conditions

Mental combat stress

Mental Fatigue

Boredom

Vigilance

Attention

Schema

Motivation

Leadership

Cognitive Workload

MANPRINT (Manpower) Conditions

Feedback loop

Measures

Tailor-ability

Precision

Timeliness

Relevant info

METT-TC

MANPRINT (HFE) Conditions

User Usability

Cognition

Indirect Sensing (Perceptual tasks)

Information processing

Attention Resources

Personality

Knowledge (Network)

Mental updates

Mental updates

Knowledge (Human)

Skills

Anticipation

Experience

Abilities

Aptitude

STM

Long-term memory

Habits

Character

Temperament

Mood

Belief

bias

Sub-Measures

System Synthesis

data

Information Conditions

Network Workload

MANPRINT (Personnel) Conditions

Cognitive Workload

MANPRINT Conditions

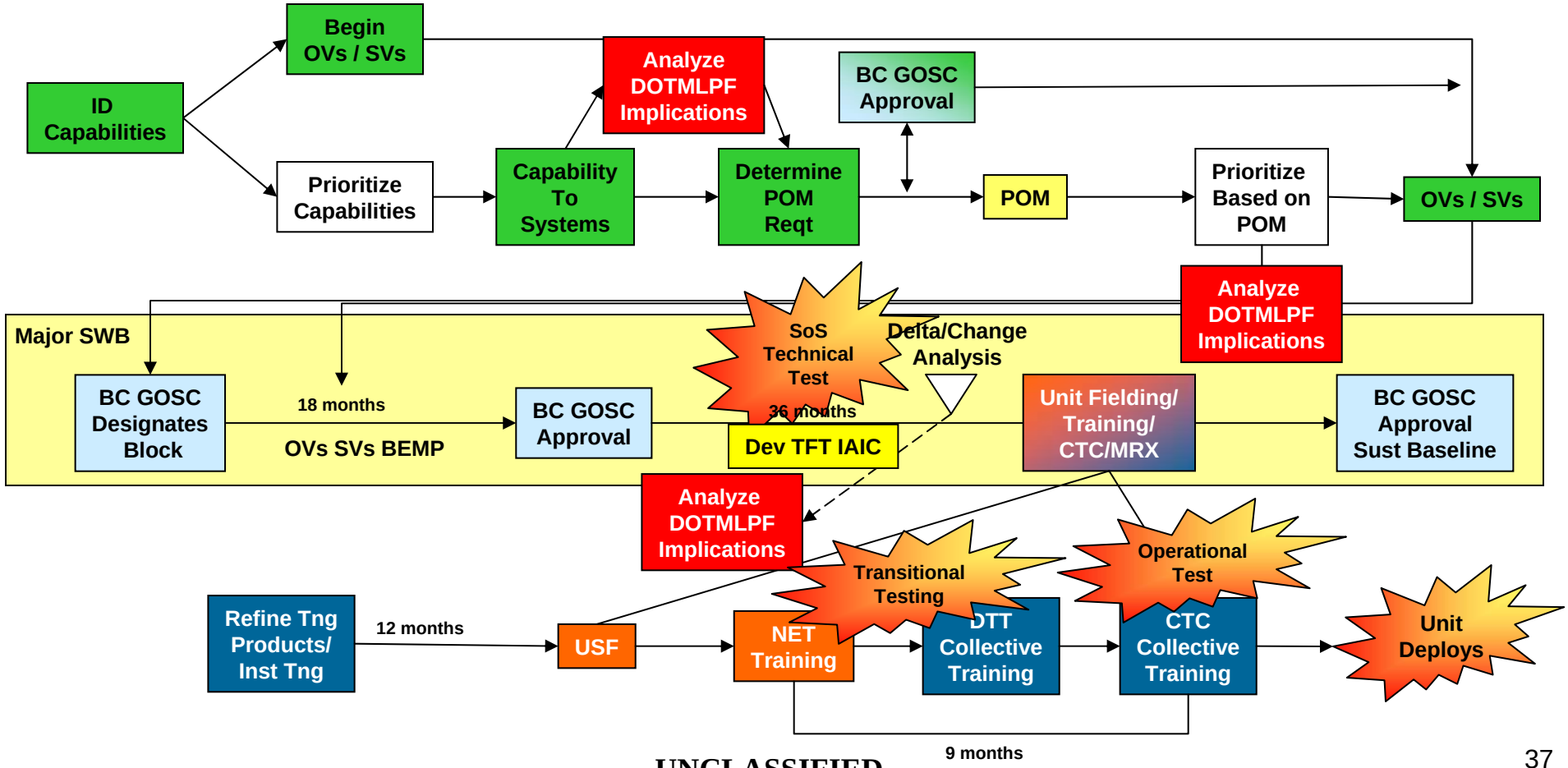
Training

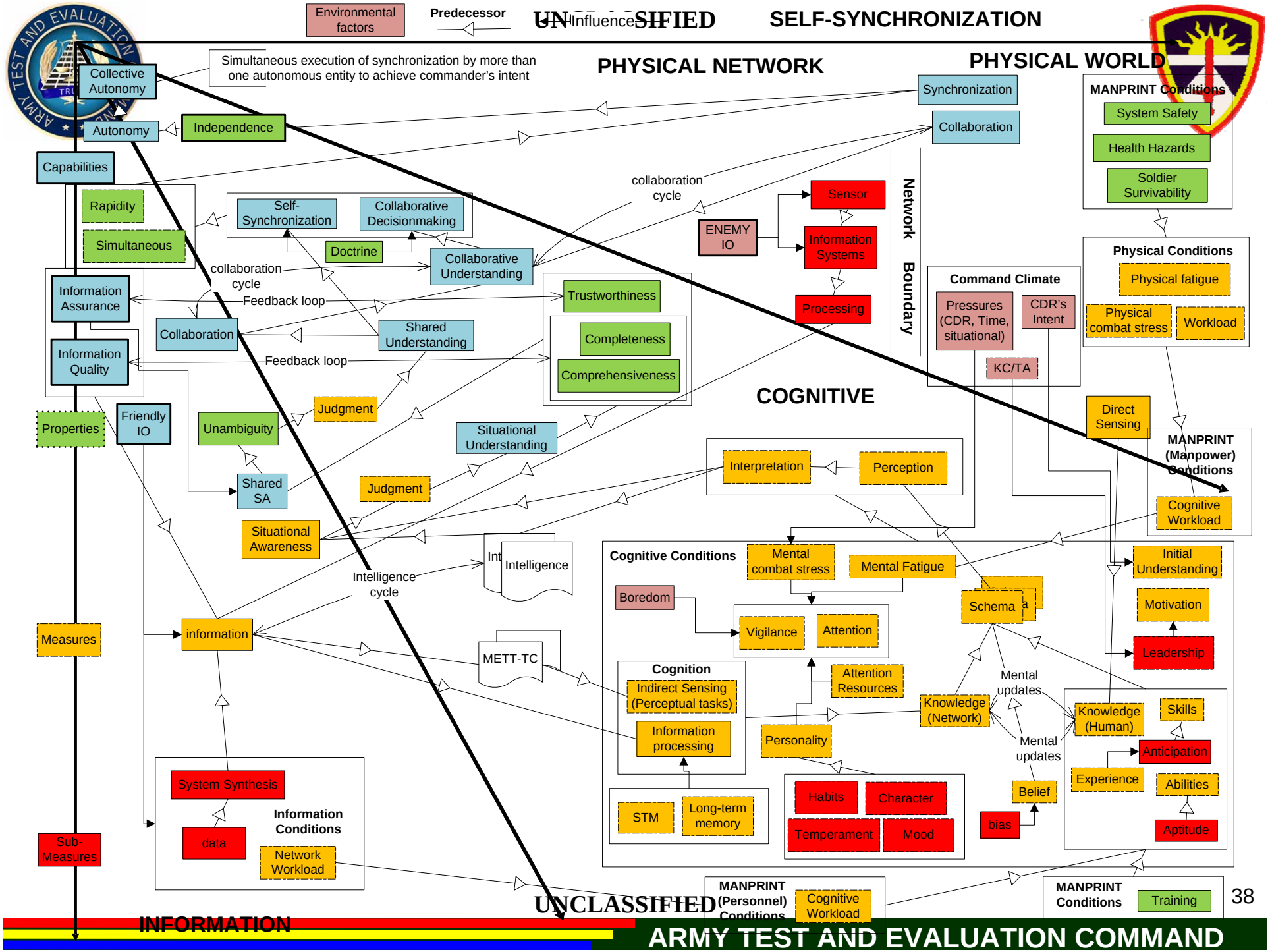
Back Up Slides

Net-Enabled Battle Command
Integrated SoS T&E Cycle

LandWarNet Warfighter Mission Area (WMA) Integrated Working Group (IWG), Transition Sub-Working Group (TWG) Mission:

- **Set the conditions for units to be successfully deployed (trained and ready)**
- **Identify and document issues that may impact the successful readiness for each rotation**




Environmental factors
Predecessor
Influence
UNCLASSIFIED
SELF-SYNCHRONIZATION
Simultaneous execution of synchronization by more than one autonomous entity to achieve commander's intent
PHYSICAL NETWORK
PHYSICAL WORLD
Collective Autonomy
Autonomy
Independence
Capabilities
Rapidity
Simultaneous
Self-Synchronization
Collaborative Decisionmaking
Doctrine
Collaborative Understanding
collaboration cycle
Information Assurance
Information Quality
Feedback loop
Collaboration
Shared Understanding
Trustworthiness
Completeness
Comprehensiveness
Synchronization
Collaboration
Sensor
ENEMY IO
Information Systems
Processing
Network Boundary
MANPRINT Conditions
System Safety
Health Hazards
Soldier Survivability
Physical Conditions
Physical fatigue
Physical combat stress
Workload
Command Climate
Pressures (CDR, Time, situational)
CDR's Intent
KC/TA
COGNITIVE
Properties
Friendly IO
Unambiguity
Judgment
Shared SA
Situational Awareness
Situational Understanding
Judgment
Direct Sensing
MANPRINT (Manpower) Conditions
Cognitive Workload
Interpretation
Perception
Intelligence cycle
Intelligence
Measures
information
METT-TC
Cognitive Conditions
Mental combat stress
Mental Fatigue
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Attention
Schema
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Long-term memory
Habits
Character
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Mood
Belief
bias
Sub-Measures
System Synthesis
data
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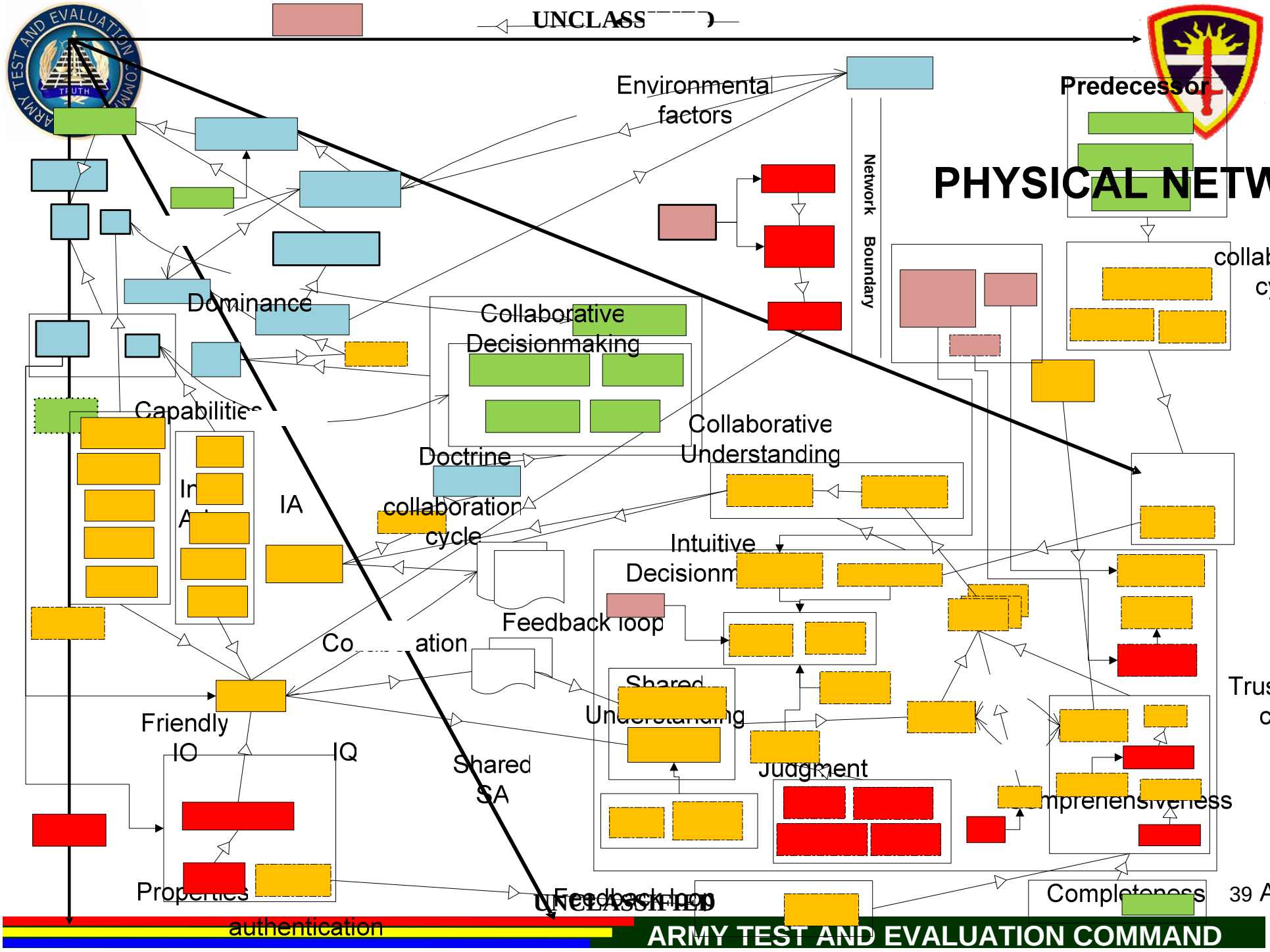
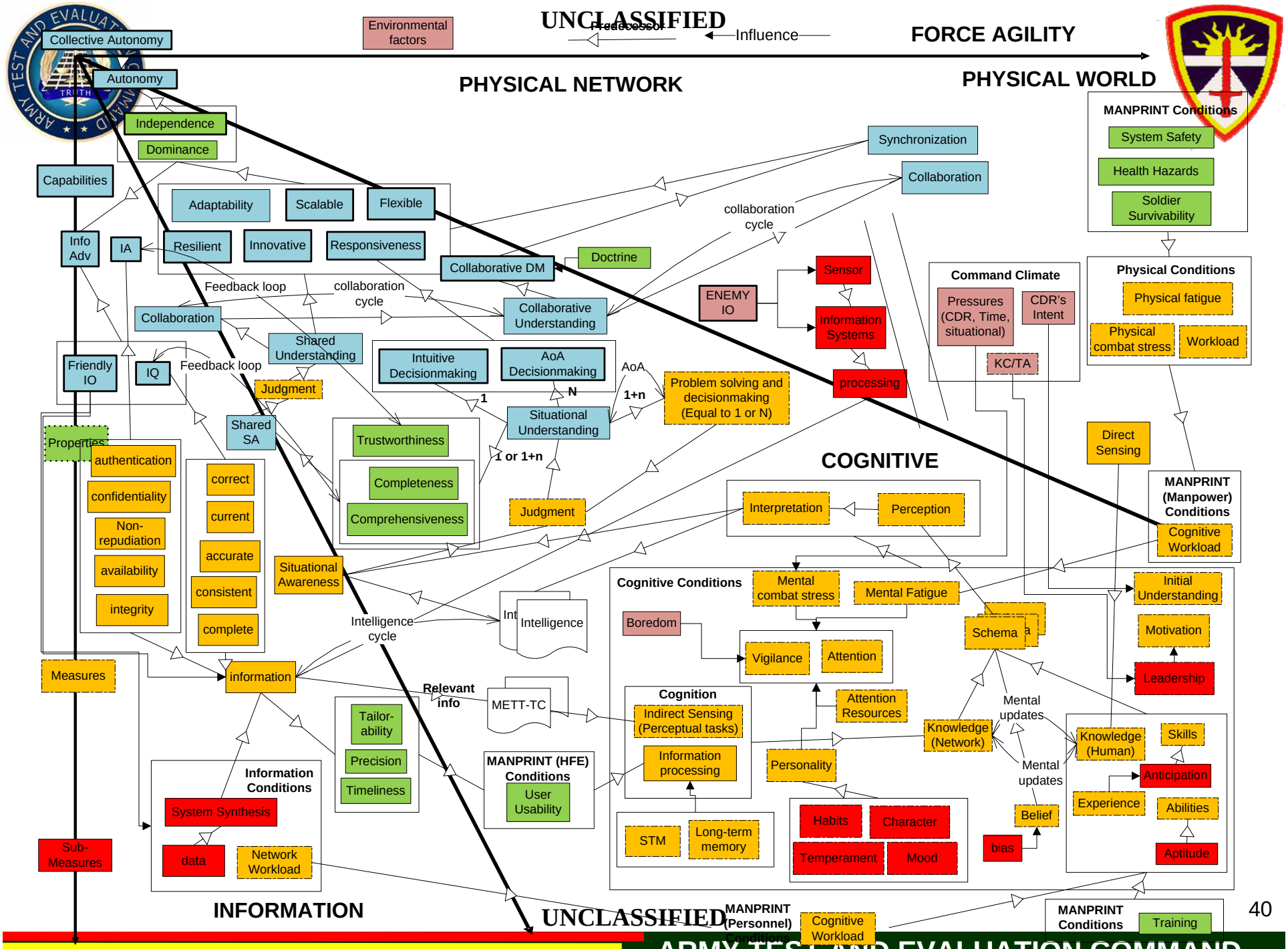
UNCLASSIFIED
INFORMATION
ARMY TEST AND EVALUATION COMMAND


UNCLASS
Environmental factors
Predecessor
PHYSICAL NETWOI
Network Boundary
collaborati cycle
Dominance
Collaborative Decisionmaking
Capabilities
Collaborative Understanding
Doctrine
IA
collaboration cycle
Intuitive Decisionm
Feedback loop
Co ation
Trustwort confid
Friendly IO
IQ
Shared SA
Judgment
mprehensiveness
Cons
Properties
Completeness
39 Accura
UNCLASSIFIED
authentication
ARMY TEST AND EVALUATION COMMAND
correct
confidentiality
Situational


UNCLASSIFIED
Environmental factors
Predecessor
Influence
FORCE AGILITY
PHYSICAL NETWORK
PHYSICAL WORLD
Collective Autonomy
Autonomy
Independence
Dominance
Capabilities
Adaptability
Scalable
Flexible
Resilient
Innovative
Responsiveness
Info Adv
IA
Synchronization
Collaboration
collaboration cycle
Collaborative DM
Doctrine
Feedback loop
collaboration cycle
Collaboration
Collaborative Understanding
Shared Understanding
Friendly IO
IQ
Feedback loop
Judgment
Intuitive Decisionmaking
AoA Decisionmaking
AoA
1
N
1+n
Problem solving and decisionmaking (Equal to 1 or N)
Situational Understanding
1 or 1+n
Shared SA
Trustworthiness
Completeness
Comprehensiveness
Judgment
Properties
authentication
confidentiality
Non-repudiation
availability
integrity
correct
current
accurate
consistent
complete
Situational Awareness
Intelligence cycle
Intelligence
Measures
information
Relevant info
METT-TC
Tailor-ability
Precision
Timeliness
Information Conditions
System Synthesis
data
Network Workload
Sub-Measures
INFORMATION
ENEMY IO
Sensor
Information Systems
processing
Command Climate
Pressures (CDR, Time, situational)
CDR's Intent
KC/TA
MANPRINT Conditions
System Safety
Health Hazards
Soldier Survivability
Physical Conditions
Physical fatigue
Physical combat stress
Workload
Direct Sensing
COGNITIVE
Interpretation
Perception
MANPRINT (Manpower) Conditions
Cognitive Workload
Cognitive Conditions
Mental combat stress
Mental Fatigue
Boredom
Vigilance
Attention
Schema
Initial Understanding
Motivation
Leadership
Cognition
Indirect Sensing (Perceptual tasks)
Information processing
Attention Resources
Personality
Knowledge (Network)
Mental updates
Knowledge (Human)
Skills
Anticipation
Experience
Abilities
Aptitude
Mental updates
Belief
bias
STM
Long-term memory
Habits
Character
Temperament
Mood
MANPRINT (HFE) Conditions
User Usability
MANPRINT (Personnel) Conditions
Cognitive Workload
MANPRINT Conditions
Training
UNCLASSIFIED
ARMY TEST AND EVALUATION COMMAND
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